

**Strategy for Restoration and Protection of Scenic River Watersheds  
Through Nutrient Management of Agricultural Activities**

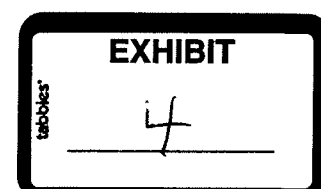
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All of the agricultural related activities, except two nurseries, under the Oklahoma Department of Agriculture, Food, and Forestry's (ODAFF) jurisdiction do not discharge directly to the Scenic River watersheds, which include the Upper Illinois River watershed with Upper Illinois River, Flint Creek and Barren Fork in stream segment 121700, Lee Creek and Little Lee Creek in segment 220200, and Upper Mountain Fork River in segment 410210. However, land application of poultry litter or other agricultural waste above the agronomic rates or applying on land already saturated with nutrients may become a non-point source contributing to the degradation of the water quality of the Scenic Rivers. The irrigation tail-water return flow from plant nurseries in the Illinois River watershed could also contribute to the degradation of the water quality of the scenic rivers. Evaluation of the impact of these potential sources is necessary to establish a proper strategy to protect the scenic rivers and their watersheds.

**I- Tasks Performed by ODAFF:**

**(1) For Poultry Operations:**

- Assisted growers in developing Animal Waste/Nutrient Management Plans. Currently more than 80% of poultry operations have submitted copies of these plans to ODAFF. Two ODAFF contract soil scientists have written 382 Animal Waste Management Plans for poultry operations.
- Conducted inspections of all poultry operations located in the watersheds. 343 inspections were performed by ODAFF poultry inspectors from July 1, 2005 to December 31, 2005.
- 1,790 technical assistances were provided in fiscal year 2004 to the poultry operations.
- From August 1, 2004 to December 31, 2005, ODAFF performed 44 enforcement actions against violators of poultry statutes and rules located in the watersheds.
- Coordinate with intra and interstate agencies/entities in developing Comprehensive Nutrient Management Plans (CNMP) for the point and non-point sources located in the impaired watersheds. Agricultural Environmental Management Services (AEMS) Division of ODAFF has recently finalized a cooperative agreement with Natural Resources Conservative Service (NRCS) of USDA to develop CNMPs for those operations applying for Environmental Quality Incentives Program (EQIP) fund for improving their systems.
- Continue to pursue cost-effective alternative methods of disposal of excess litter through ODAFF Market Development Division and Office of the Secretary of the Environment.
- Continue to assist growers in developing Animal Waste Management Plans (AWMP) and/or Nutrient Management Plans (NMP).
- Accelerate inspection and enforcement actions against violators of the Registered Poultry Feeding Operations Act and the permanent rules, and those



who do not comply with requirements of Animal Waste/Nutrient Management Plans.

(2) For Nursery Operations:

- Nursery operations were monitored monthly for nitrate-nitrogen, total-phosphorous and pesticides from 1989 to 2001. Results have been published in *The Curtis Report 1989 –1992*, 1993, 1994, 1995, 1996, 1997
- Signed voluntary compliance agreements with nursery operations to reduce nutrient loading.
- Notified nurseries when they were out of compliance.

II- Evaluation of the Impact of Agricultural Sources Located in the Scenic River Watersheds:

- Poultry Farms: There are 111 poultry operations, more than half of them raising broilers, registered with ODAFF, consisting of 92 operations in the Upper Illinois River (UIR) watershed encompassing parts of Adair County, Cherokee County and Delaware County; 3 operations in the Lee Creek/Little Lee Creek (LLC) watershed encompassing parts of Adair, Leflore and Sequoyah Counties; and 16 operations in the Upper Mountain Fork (UMF) watershed encompassing part of McCurtain County. These operations manage a total of 462 houses with 429 houses and 8,001,330 birds in UIR watershed, 8 houses and 140,800 birds in LLC watershed, and 25 houses and 301,400 birds in UMF watershed. The trend is: number of operations as well as number of poultry houses decreased; however, houses are being built larger, resulting in more number of bird spaces from 8,309,510 in 2004 to 8,443,530 this year, approximately 1.6% increase. The number of birds in UIR watershed increased approximately 2.9 %, from 7,766,710 in 2004 to 8,001,330 this year. While the number of birds in LLC and UMF watersheds decreased 23% and 16% respectively.
- Amount of Litter Produced and Nutrient Generated by Poultry Farms: More than half of the poultry operations in the watersheds raise broilers, and broilers normally generate more litter and nutrient than pullets, layers and turkeys. In the context of this report, the total amounts of litter and nutrients produced for all operations are estimated based on broiler's production rate of 18 lbs of litter per year per space, and its nutrient values of 46 lbs of total Nitrogen and 53 lbs of P<sub>2</sub>O<sub>5</sub> per ton of litter.<sup>(1)</sup> The estimated amount of litter and nutrients generated in the different watersheds per year are as follows:

<u>Watersheds</u>	<u>Litter (ton)</u>	<u>Total N (ton)</u>	<u>P<sub>2</sub>O<sub>5</sub> (ton)</u>	<u>Phosphorus P (ton)</u>
UIR	72,012	1,656	1,908	833
LLC	1,267	29	34	15
UMF	2,713	63	72	31
Total:	75,992	1,748	2,014	879

<sup>(1)</sup> Table 11: Estimated Solid Manure Characteristics, Manure Characteristics, Manure Management System Series, Midwest Plan Service (MWPS)-18, Section 1.

Compared to last year, there is a slight increase (about 1.6 %) in litter produced, from 74,785 tons to 75,992 tons, resulting in a small increase of  $P_2O_5$  generated: from 1,981 tons in 2004 to 2,014 tons this year.

The above estimation based on the actual bird space is more conservative than the traditional method of estimating based on a litter production rate of 125 tons per year per house. Since the houses are larger, the number of chicken spaces per house increase as well as the amount of litter generated. The total amount of manure produced per the latter method would be 57,750 tons (53,625 tons in UIR, 1,000 tons in LLC and 3,125 tons in UMF). Thus, the former method is more appropriate in evaluating the impact of poultry industries in the watersheds. It is also noted that the OSU (Oklahoma State University) Extension Facts F-2228 "*Fertilizer Nutrients in Animal Manure*" specified an average content of  $P_2O_5$  of manure in Oklahoma of 61lbs per ton of manure for broiler. Based on this phosphorus content and the latter method for estimating manure produced of 57,750 tons, the total amount of  $P_2O_5$  generated in the watersheds would be 1,761 tons, compared to 2,014 tons per the former method as presented in the above table. The difference between the two methods is within 12.5 % of each other.

The contents of Nitrogen (N) and Phosphorus (P) under the form of  $P_2O_5$  in poultry litter are almost the same ratio: 1:1. However, litter is normally applied only onto the soil surface, and a considerable amount of nitrogen in the form of Ammonium ( $NH_4$ ) will be converted to Ammonia ( $NH_3$ ) and released to the air. Thus, the total N available for plant use is reduced. Meanwhile the demands of N for most crops are much higher than Phosphorus. To satisfy crop growth based on N need, litter would have to be applied at a higher rate, resulting in the build-up of unused Phosphorus in the soil. Run-off and erosion may carry the extra Phosphorus to the nearby streams. Several Scenic Rivers, especially the Illinois River, were affected by the presence of a high level of Phosphorus. Controlling Phosphorus will be very critical in the restoration and protection of these rivers.

- Soil Test Phosphorus (STP): ODAFF inspectors collected soil samples for STP at poultry operations located in several counties in the Scenic River watersheds in Summer and Fall of 2002. The results indicated that more than 39% of samples collected exceeded the STP of 250, the threshold above which only half of normal phosphorus loading rate is recommended to apply. Code 590 of the Natural Resources Conservation Service (NRCS) on Nutrient Management classified as Moderate rating for the soil with STP between 66 and 250, and recommended a full rate of waste application of 200 lbs of  $P_2O_5$ , which is equivalent to 3.7 tons of litter, or less per acre of land with slope less than 8% and soil more than 20" deep. For High rating of soil with STP between 250 and 400, NRCS recommended half of the application rate for phosphorus.

The results of samples collected by ODAFF inspectors also indicated that more than 77% of the samples exceeded the STP of 120 and more than 33% of the samples exceeded the STP of 300.

- Impact Evaluation of Land Application of Poultry Litter on the Watersheds:  
 Since the above samples do not cover all lands located in the watersheds, that are either being used as land application sites or that may be available for future land application sites, the extra phosphorus loading, above and beyond the soil capacity for agronomic use, could not be accurately estimated. On the other hand, the limited data of STPs for lands currently being used for litter application in the watersheds, which have been submitted by Poultry Litter Applicators in their annual report for the year 2004 to the ODAFF office, showed a better picture with approximately 25.9% of samples exceeding STP 120, 5.6% of the samples exceeding the STP of 250, and 3.2% of samples exceeding STP 300. These undoubtedly appear to be more positive. Based on a threshold of STP of 250 and the results of soil tests collected by ODAFF inspectors, we assumed that 39% of lands with STP of 250 located in the watersheds that are being used for litter application are at capacity for P loading. Similarly, based on STP thresholds of 120 and 300, and ODAFF inspectors soil test results the percentage of land at capacity for P loading would be 77% and 33% respectively. As a conservative measure for pollution prevention at the source, it is estimated that the amounts of extra poultry litter presented below, based on different STP thresholds of 120, 250 and 300, should either be transferred out of each watershed or be applied onto other available lands in the watersheds:

<u>Watersheds</u>	<u>Extra Litter (STP 120)</u>	<u>Extra Litter (STP 250)</u>	<u>Extra Litter (STP 300)</u>
UIR	55,449 tons	28,085 tons	23,764 tons
LLC	976 tons	494 tons	418 tons
UMF	2,089 tons	1,058 tons	895 tons
Total	58,514 tons	29,637 tons	25,077 tons

The percentage of lands at capacity for P loading and the estimated amount of extra litter above will be revised once all STPs data are submitted to and verified by ODAFF and/or additional STP samples are collected by ODAFF inspectors. These values will also be reevaluated based on the updated STP thresholds once revised or finalized by NRCS and/or OSU.

Depending on the terrain and slopes of the sites, the proximity to the Scenic Rivers and the nature and conditions of the intermediate zones between the sites and the waters, the impact could be significant or negligible. Therefore, to accurately estimate the impact of agricultural activities on water quality of Scenic Rivers, especially of the poultry operations in the watersheds, in-stream monitoring stations to measure nutrient levels up and downstream of the operations, above and below the operations and at the state line for

monitoring of interstate phosphorus contributions should be established. Monitoring data will also help in reevaluating the effectiveness of pollution prevention measures applied in the watershed and the appropriateness of currently recommended STP threshold value. In monitoring nutrient levels at the edge of the operation fields or land application areas, site-specific STP threshold could be developed for each watershed and put in use for stricter control of Phosphorus loading in the watershed.

- Status of Nursery Operations: There are two (2) large containerized plant nurseries along the Illinois River that have had irrigation tail-water return flow enter the river. These operations were monitored monthly for nitrate-nitrogen, total-phosphorous and pesticides from 1989 to 2001. One operation became totally contained in 1998 and only has runoff leaving their property during large rainfall events. These nurseries signed voluntary compliance agreements with ODAFF to reduce their yearly average nitrate level in their discharge from a high of 27.99 mg/l NO<sub>3</sub>-N in 1989 to 10 mg/l in 1996. They also agreed to reduce the Phosphorus (total) level down to 1 mg/l.

### III- Setting Goals for Reducing the Impact:

- Phase 1: 50% reduction of potential agricultural sources, to be achieved in 5 years.
- Phase 2: 100% of potential agricultural sources, to be achieved in 10 years.

Depending on resources available, the results of further soil sampling and the assessment of the level of impact contributed by agricultural sources on the watersheds, the above goals could be reevaluated in the future.

### IV- Strategy to Achieve the Goals:

#### (1) For Poultry operations:

- Evaluate the accuracy of STP data of lands located in the watersheds as submitted by poultry applicators through required annual reports to ODAFF; spot check the STPs, by conducting on site inspection and soil sample collection. Notify the applicators of the sites with currently more than an STP of 250 and do not allow them to apply additional litter on these lands.
- Coordinate with growers in locating available lands in the watersheds with STP less than 250 for future land application of litter. This will help determine the amount of litter, if any, to be transferred out of the basins/watersheds.
- Measure in-stream P levels upstream and downstream of the poultry operations and/or litter land application sites by setting up monitoring stations in the Scenic Rivers. Get access to and evaluate currently available OWRB BUMP or USGS data on nutrient levels in the watersheds.
- Evaluate the above data to determine effectiveness of land application restrictions, and the appropriateness of the recommended STP threshold value.
- Select a typical litter land application site located within ¼ miles of a scenic river, coordinate with grower and/or NRCS to monitor phosphorus levels in the runoff water within 100 feet outside of the perimeter of the land

application field after storm events, and to measure the phosphorus content of the soil of the field to determine the phosphorus amount leaving the field, if any, in order to develop or adjust the STP threshold specific for the watershed or sub-watershed.

(2) For Nursery Operations:

- Conduct an inventory of fertilizer and pesticide operations in the scenic river watersheds.
- Monitor the irrigation return flow of the one remaining nursery to maintain compliance with the voluntary compliance agreements and the new phosphorus standard.
- Monitor the river upstream and downstream from the nursery operations to determine if impact to the river is occurring.
- Assist operations with developing management plans to reduce nutrient loading.
- Involve pesticide manufacturers if pesticides are detected in any irrigation tail-water due to normal label use.
- Work toward total retention and recycling of the irrigation water with the use of state and federal assistance within 10 years.